



## CVIN LLC

Central Valley Next-Generation Broadband Infrastructure Project (CVNGBIP)

### **CVNGBIP Underground Plant Construction Specifications**

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Prepared by: Engineering Associates, Inc.

PURPOSE: This document provides CVIN, consulting engineers, contractors and other interested parties with information on the construction of underground plant facilities. This document is based on national telecommunications standards for rural networks, and has been customized to the parameters of the CVIN network.

# **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

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## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

### **3. Abbreviations**

ASTE:	American Society for Test Engineering
ASTM:	American Society for Testing Materials
°C:	Degrees Celsius
Cm:	Centimeter
CT :	Construction Truck
°F:	Degrees Fahrenheit
Ft:	Foot or feet
ft/min:	Feet per minute
kg:	Kilograms
lbs:	Pounds
in.:	Inches
m:	Meter
cm:	Cubic Meters
m/min:	Meters per minute
mm:	Millimeter
MPa:	Megapascals
NESC:	National Electrical Safety Code
Psi:	Pounds per square inch
R/W:	Right-of-way
TE&CM:	Telecommunications Engineering and Construction Manual
UCV:	Underground Cable Vault

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### **4. Definitions**

**Aggregate:** The mineral materials such as sand or stone used in making concrete.

**ASTE:** American Society for Test Engineering- organization that tries to help the test professional perform their work faster, more efficiently, and with greater quality.

**ASTM:** American Society for Testing Materials, develop international standards for material, products, system and services used in construction.

**Backfill:** Materials such as sand, crushed stone, sand slurry, or soil, which are used to refill a trench after conduits or cables have been laid therein.

**Cable Rack:** A device usually secured to the wall of an underground cable vault (UCV), cable raceway, or building to provide support for cables.

**Conduit or Duct:** A tubular raceway for holding wires or cables, which is designed expressly for, and used solely for, this purpose.

**Conduit Run:** An arrangement of conduit providing one or more continuous conduits between two points.

**Construction Drawings:** The drawings developed through the staking process and used to guide the construction of outside plant facilities.

**Eligible Country:** Any country that applies with respect to the United States an agreement ensuring reciprocal access for United States products and services and United States suppliers to the market of that country, as determined by the United States Trade Representative.

**Engineer:** Engineering Associates Inc.

**FuturePath®:** FuturePath is a configuration of MicroDucts surrounded by a Medium Density Polyethylene (MOPE) covering. FuturePath® applications provide the ability to install additional fiber cables as the network grows, all within the same duct structure. Utilizing MicroTechnology, FuturePath® allows maximum cost effectiveness and greatest return on investment for existing and future network builds. Current telecommunications infrastructure reaches its maximum utilization with the introduction of MicroTechnology. FuturePath® can be placed in a number of applications, from aerial to direct buried, horizontally directionally drilled (bored), or pulled into underground conduit systems.

**H20:** a UVC with a full traffic rated steel lid that has a 20 thousand pound wheel rating to withstand continuous traffic loads.

**Inspector:** The competent representative of the Engineer or Owner who is delegated full time "on site" Construction Administration responsibilities of the Engineer or Owner.

**Owner:** CVIN LLC

**Right-of-Way:** The strip of land over which facilities such as highways, railroads, power lines, other utilities, or telecommunication lines are constructed.



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**Roding:** A device that can be either pulled or pushed through a conduit that cleans the conduit of stones, rubble, etc. and prepares the conduit to receive the cable.

**Sand Slurry:** Flowable fill (sand slurry), is a concrete-like mixture poured into a trench in place of compacted soil or crushed rock. Flowable fill is placed easily and quickly into narrow, difficult compact trenches. The flowing quality of this concrete-like mixture can fill hard to reach areas and displace standing water in trench. 1 Sack sand slurry per yard consists of 94 pounds of cement and 3,200 pounds of sand and water.

**Sieve:** A wire mesh or closely perforated metal used for straining, sifting, or ricing.

**Silicore Conduit®:** Silicore conduit is co-extruded with tough, durable High Density Polyethylene (HDPE) jacket. SILICORE® ducts provide complete cable protection before, during and after installation. The ultra-slick permanent lining remains for future repairs, replacements or upgrades.

**Stringer:** A long, heavy horizontal timber used for any of several connective or supportive purposes.

**Subsidiary Conduit:** A minor or lateral spur conduit route leading from an underground cable vault or jointing chamber to a building or distribution point.

**Underground Cable Vault (UCV):** A subsurface chamber for the purpose of installing cables and other devices, and for making connections and tests.

**20k:** A UVC with a 20 thousand pound wheel rating to withstand only intermittent traffic load.

## **5. Document Highlights**

This document specifies methods for construction of underground plant facilities using fiber optic cables. The information and recommendations in this bulletin are mandatory. Deviations from this specification shall be made only with the prior written approval of the engineer and/or owner.

Some of the work items associated with underground plant construction is as follows:

- Pre-installation inspection of UCVs and conduits;
- Installation of conduits and UCVs;
- Excavation of precast UCV pits;
- Installation and inspection of bracing, if required, for precast UCV pits;
- Pre-installation inspection of fiber optic cables;
- Installation of fiber optic cables in conduits and UCVs;
- Splicing and testing of fiber optic cables

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### **6. General Safety Precautions**

#### **6.1 CVIN LLC Jobsite Safety Requirement Summary**

Contractors who engage in construction activities for **CVIN LLC** must comply with all applicable workplace safety standards as required by Cal/OSHA and federal OSHA.

*Contractors will be required to submit PDF and printed copies of their Company Safety Manuals to CVIN LLC after contracts are executed, and prior to the commencement of construction.*

Contractors' responsibilities include, but are not limited to, areas listed below:

<b><u>Administrative Functions</u></b>	<b><u>Safety Hazards and Hazardous Activities</u></b>
Hazard Communication	Asbestos
Recordkeeping	Chemicals
Reporting Requirements	Crystalline Silica Inhalation
Safety Inspections	Electrical Installations
Safety Training and Awareness	Excavating & Trenching
Weekly Safety Meetings	Horizontal Directional Drilling
<b><u>Safety Provisions</u></b>	Fall Protection
Clothing - Long Pants, Boots, Hardhats, etc.	Fire Prevention
Drinking Water	Flammable and Combustible Liquids
Eye and Face Protection	Gases, Vapors, Fumes, Dusts, and Mist
Head Protection	Hand and Power Tools
Hearing Protection	Hazardous Waste Operations
Housekeeping	Grinding and Cutting
Illumination and Lighting	Heat Related Illness
Medical Services and First Aid	Highway Work Zones – Traffic Control
Personal Protective Equipment	Laser Light
Respiratory Protection	Mechanized Equipment
Signs, Signals, and Barricades	Motor Vehicles
Toilets	Noise
Washing Facilities	Reinforcing Steel
	Underground Construction
	Welding, Cutting and Heating

Information on federal OSHA regulations, programs, and activities is available on OSHA's website: [www.osha.gov](http://www.osha.gov).

Information on California OSHA regulations, programs, and activities is available on Cal/OSHA's website: [www.dir.ca.gov/DOSH](http://www.dir.ca.gov/DOSH).

#### **6.2 Additional Safety Considerations**

Open UCVs shall be guarded at all times with either UCV guards or barricades. These and other warning devices shall be set up at UCVs before removal of UCV covers.

During construction of underground plant, warning lights shall be placed between sunset and sunrise and when vision is impaired by fog, haze, etc. Warning lights shall be placed in accordance with local, State, and/or Federal ordinances.

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Flames, torches, lit tobacco products, etc. shall not be brought near open UCVS, into covers or tents over UCV openings or into UCVs until tests for combustible gases indicate that no such gases are present in the UCVs.

When lighting and heating equipment are to be used in UCVs, only lighting and heating equipment designated for use in UCVs shall be used. Connection and disconnection of lighting and heating equipment shall be performed outside of UCVs.

Trenching operations of conduit and UCV systems within areas of subsurface structures shall be carried out in a manner that will avoid accidental contact of the digging tools with such structures. The equipment, which is used for such operations, shall be operated only by qualified personnel. When foreign subsurface structures are encountered such as power cables, Community Antenna Television cables, gas lines, etc., installations of conduit and UCV systems shall be performed in accordance with the requirements of the latest edition of the NESC or Federal, State, or local codes. Where Federal, State, or local codes are more stringent than the NESC, installations of conduit and UCV systems shall be performed in accordance with the more stringent codes.

UCVs opened for the first time during the day or reopened after having been closed for any length of time shall be tested for the presence of combustible gases. Additional tests shall be performed at the start of each work shift change and at intervals not to exceed two hours during work shifts. UCVs covered with tents or tarpaulins shall be tested for combustible gases at intervals not to exceed one hour. UCVs shall also be tested for combustible gases after removal of conduit plugs, which could possibly have permitted the flow of gases into UCVs. Where gases are detected or suspected, UCVs shall be ventilated using forced fresh air equipment in accordance with the manufacturer's instructions.

Adequate communications shall be established between cable feeding locations and other cable placing equipment locations prior to starting of placing operations.

Construction materials and tools shall be arranged in such manners to avoid the possibility of such materials and tools falling into UCVs or unnecessarily interfering with pedestrian or vehicular traffic.

Caution shall be exercised when entering or exiting UCVs, particularly UCVs located on traveled thoroughfares. Ladders shall be provided as needed for entering and exiting UCVs. Entering and exiting UCVs shall be performed facing oncoming traffic. Hands shall be kept free of materials or tools when ascending or descending ladders.

Special care shall be exercised to avoid damage to fences, trees, lawns, and shrubs during installations of conduit and UCV systems. Damages to fences, trees, lawns, and shrubs shall be repaired. All existing sidewalks, roads, facilities, etc. that are damaged during the installation of the work shall be repaired to its pre-existing condition.

### ***6.3 Warning Signs (Rhino 3 Rail Fiber Optic Cable Marker)***

The Rhino Hybrid 3-Rail specially designed reinforcing fibers are blended with UV stable plastic to create a flat post with the bright color of plastic and the impact resistance of the combined fiberglass and plastic. Its design allows the post to bend over when hit, then snap back into its normal upright position.

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EXAMPLE (CVIN LLC will supply special decals to attach to Warning Sign)

In general, Contractor is responsible for posting of these Rhino Fiber 3-Rail Warning Signs, per manufacturer's installation standards, every +/-2640 feet (½-mile) in rural areas and in the urban areas every +/-1320 feet (¼-mile), and at every UCV and any conduit splice located between UCV's (except in sidewalks or other impractical urban areas), to ensure the fiber and structure can be located and is not damaged in the future. Other placement instructions are specified in the appropriate sections of this document. Warning signs and decals shall be supplied by Owner. Contractor shall notify Owner of all mid-span conduit splices as that quantity is not accounted for in the Bid Unit quantity summary.

### **7. General Instructions for Handling and Care of Materials During Construction**

All fiber optic cable installed on this project shall be placed into the conduit via a jetting process as detailed in this specification. Extreme care shall be exercised in handling materials during the construction process. Underground cable placing operations shall be inspected at all times to ensure that maximum cable placing tensions are not exceeded. Under no circumstances shall maximum placing tensions be allowed to develop in the cables during placing operations.

Exceeding maximum cable placing tensions could result in damages to cables. Whenever placing operations are stopped, cables shall remain under tension. When restarting placing operations, tensions on cables shall be gradually increased in steps of a few seconds apart until cables are once again in motion.

Cable reels delivered to work locations but not set up immediately for placing operations shall be securely blocked or secured to substantial supports to prevent rolling or movement of reels. Cable reels used in placing operations

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shall not be left on grades or in traffic lanes. When reels are required to be left on grades, reels shall be turned against curbs and blocked to prevent rolling of reels.

Cable reels stored overnight on streets or highways shall be marked in accordance with local, State, or Federal regulations. If no local, State, or Federal marking regulations exist for storing reels overnight on streets or highways, reels shall be barricaded and lit with flashing lights or red lanterns not later than one-half hour before sunset.

Care shall be exercised to prevent damage to exposed cables during the construction period. Construction work shall be scheduled to keep such exposure to a minimum. Cables left exposed are susceptible to damage. Cables left exposed are also considered hazards to vehicles, pedestrians, or animals.

Fiber optic cables in UCVs shall be racked in accordance with the construction drawings and spliced in underground filled splice cases as soon as practicable. The installation work shall be completed within one week after the cables have been installed.

Underground plant connections using dissimilar metals shall be avoided to eliminate the possibility of galvanic corrosion. Therefore underground plant connections shall be made using only stainless steel, tinned, or zinc, coated metals.

When working in UCVs care shall be exercised to prevent damage to cables in setting up placing apparatus or while using tools of any kind. Cables, splice cases, etc. shall not be used as steps for entering or exiting UCVs.

## **8. Repair of Cables Damaged During Construction**

Minor damage to the outer jackets, where the shields or armors of the cables have not been bent, abraded, or penetrated shall be repaired in accordance with CVIN Specifications for Splicing Copper and Fiber Optic Cables.

Cables found to be damaged after installation shall be repaired. If the damage is considered minor, the damage shall be repaired in accordance with CVIN LLC Specifications for Splicing Fiber Optic Cables. If the damage is considered major, the damage shall be repaired either by replacing the damaged sections with new cables spliced to the undamaged sections of the cable or repaired in accordance with the method specified in the contract.

## **9. Call Before you dig USA 1-800-227-2600**

### ***9.1 Survey and mark***

Survey your proposed excavation site. Mark the excavation area on pave surfaces with white spray chalk, water base, UV paint or equivalent less permanent type markings. Use flags, stakes or whiskers in non-paved areas.

### ***9.2 Call before you dig***

Call USA 2 working days to 14 calendar working days before you dig in California or Nevada. Only operators who are members of USA will be notified.

### ***9.3 Wait required time***

The legal 2 working days to 14 calendar days notice in California and Nevada allows USA members to examine their underground facility records and respond to you. Excavators are required by law to wait until all operators of subsurface installations have provided a positive response to their excavation site.

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### **9.4 *Respect the marks***

Preserve facility marks for the duration of the job. If any marks are not reasonably visible, you **must** call USA and request a re-mark. A re-mark request requires a 2 working day notice. When you request and operator to re-mark their facilities, you will be asked if your excavation site is still outlined in white.

### **9.5 *Dig with care***

In California and Nevada do not excavate within 24" of the outside diameter of the facility. Facilities that are in conflict with your excavation are to be located with hand tools and protected before power equipment is used. Notify the affected utility of any contact, scrape, dent, nick or damage to their facility.

## **10. Trench Excavating, Grading, and Conduit Laying**

### **10.1 *Trenching Techniques***

The goal of trenching is to construct a trench in a manner that it properly supports and protects the pipe. This must be done while making the process of laying pipe as easy as possible and while protecting the safety of the crew and the public. This goal shall be met with minimal side effects: minimum damage to public and private property, minimum disruption of service, and as little inconvenience to the public as possible.

OSHA defines an excavation as any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reason of the excavation. What this essentially means is someone dug a hole in the ground in order to do some work.

A trench includes those conditions in which a conduit is installed in a relatively narrow ditch that has been cut in undisturbed soil and the ditch is backfilled to the original level (OSHA defines "trench" as a narrow excavation made below the surface). Trenching is accomplished with the use of some type of mechanical machine, backhoe, trencher, rock saw or plow, operated by a reliable professional operator. This operator is responsible to the crew leader on the job. The crew leader is responsible for directing the equipment as well as the rest of the job.

### **10.2 *Trench Depths and Safety Requirements***

In this project, conduit depth of 36" will be the standard unless special circumstances or permitting agencies require different. Minimum conduit radius shall be 30". Shoring, benching or sloping trench walls may be required. Other safety issues are regulated as well. The following examples are taken from OSHA's rules, but every jurisdiction includes these regulations in some form. Worker access and egress needs to be taken into consideration. Ladders must be provided in trenches over four feet deep. They must be within twenty five feet of the workers. Ladders need to be fixed in place, and must extend over the landing. In cases where live electrical utilities exist, metal ladders are to be avoided. A "competent person" must be designated for each trenching operation. This person needs to be trained in the hazards and rules of underground work, including understanding the soil types and shoring systems. The competent person needs to be able to recognize unsafe situations, including changing conditions that could result in trench failure; signs of shoring equipment failure; and the presence of potentially hazardous gasses that can accumulate in the bottoms of trenches. This person must have the authority to make necessary changes or to stop work. Crossing over the top of trenches is generally discouraged, but if vehicles need to cross a trench, the crossing must be designed by a registered engineer. Walkways have to be at least 20 inches wide, have handrails and extend two feet past the top of the trench on both sides v Workers are not permitted to work under raised loads to prevent injury from falling objects. Hard hats and safety vests are required. Trench spoils must be piled at least two feet from the top edges of the trench.

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### ***10.3 Shoring and Excavating***

Conduit trenches excavated in firm soils shall be shored using 2 in. by 6 in. (51 mm by 152 mm) or larger planks. Planks shall be vertically spaced along both sides of trenches and braced using either jacks or 2 in. by 6 in. (51 mm by 152 mm) braces that are either cleared or rigidly wedged.

Conduit trenches excavated in firm soils shall be shored using 2 in. by 6 in. (51 mm by 152 mm) or larger planks. Planks shall be vertically spaced along both sides of trenches and braced using either jacks or 2 in. by 6 in. (51 mm by 152 mm) braces that are either cleared or rigidly wedged.

Conduit Trench Excavations  
Bracing and Sheet Piling  
Trench Widths of 4 ft (1.2 m) or Less  
Cracking or Crumbling Soils

Depth of Trench ft (m)	Sheet Piling		Stringers		Cross Bracing	
	Size in. (mm)	Horizontal Spacing ft (m)	Size in. (mm)	Horizontal Spacing ft (m)	Size in. (mm)	Horizontal Spacing ft (m)
5 to 10 (1.5 to 3.0)	2 x 6 (51 x 152)	3 (1)	4 x 6 (102 x 152)	5 (1.5)	4 x 6 (102 x 152)	5 (1.5)
10 to 15 (3.0 to 4.6)	2 x 6 (51 x 152)	2 (0.6)	4 x 6 (102 x 152)	4 (1.2)	4 x 6 (102 x 152)	4 (1.2)

Conduit trenches excavated in soils that are susceptible to cave-ins such as soft, sandy, or loose soils, trenches shall be shored and braced as indicated in Table 6 of this section. For conduit trenches having widths of 4 ft (1.2 m) or less and excavated in soils likely to either crack or crumble, trenches shall be shored and braced as indicated. For conduit trenches having widths greater than 4 ft (1.2 m) and excavated in soils likely to either crack or crumble, trenches shall be shored and braced as indicated in this section.

Conduit Trench Excavations  
Bracing and Sheet Piling  
Trench Widths Greater Than 4 ft (1.2 m)  
Cracking or Crumbling Soils

Depth of Trench ft (m)	Sheet Piling		Stringers		Cross Bracing	
	Size in. (mm)	Horizontal Spacing ft (m)	Size in. (mm)	Horizontal Spacing ft (m)	Size in. (mm)	Horizontal Spacing ft (m)
5 to 10 (1.5 to 3.0)	2 x 6 (51 x 152)	3 (1)	4 x 6 (102 x 152)	4 (1.2)	4 x 6 (102 x 152)	6 (1.8)
10 to 20 (3.0 to 6.1)	2 x 6 (51 x 152)	Tight	6 x 6 (152 x 152)	4 (1.2)	6 x 6 (152 x 152)	6 (1.8)

When excessive water is present in conduit trenches, tongue and groove sheeting shall be considered for use to reduce pumping requirements.

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When removing braces from trenches, lower braces shall be removed first. Upper braces shall be removed last to provide protection for construction personnel.

When foreign structures are encountered in trenches, it may be necessary to go to greater depths than would otherwise be required in order to obtain suitable clearances for conduits. Where this is impracticable or undesirable, foreign structures may be moved or trench lines shifted to obtain the required clearances. If foreign structures must be moved to obtain clearances, companies owning the foreign structures shall be contacted about performing the work.

Conduit trenches shall cross over gas, steam, or waterlines rather than below them provided, however, that depths of trenches would not be excessively decreased by more than one foot. For conduit sections that have less than 2'-6" of cover, provide a 6" deep sand slurry cap. Conduit trenches paralleling either above or below gas, steam, or water lines shall be avoided, as far as practicable.

Gas and oil lines shall be given special attention and precaution shall be taken to guard against fire hazards they present. Excavations in public streets shall always be checked for gas leaks, even though gas or sewer lines may not be directly encountered. Open flames of any sort shall not be permitted around excavations when gas odors are detected. Construction personnel shall not be allowed to smoke and precautions shall be taken to prevent pedestrians from throwing lighted products into such excavations. When excavations involving foreign structures are undertaken, owners of foreign structures shall be notified so that representatives of foreign structures may be present at excavations if desired.

The minimum separation between electric power conduits and telecommunications conduits shall be as indicated in the latest edition of the NESC. The minimum separation between foreign pipes such as gas, water, oil, etc. and telecommunications conduits shall be at least 6 in. (152 mm) when crossing such pipes and at least 12 in. (305 mm) when paralleling such pipes measured from the nearest part of the conduit structure.

Foreign pipes diagonally crossing trenches shall be supported when necessary. Foreign pipes paralleling trenches and either extending partially into trenches or located within 12 in.(305 mm) of trenches shall be laterally braced by shoring, except when sheeting materials used to support trench walls provide adequate bracing for pipes.

Trench beds shall be leveled to provide even bases before installing conduits. In some cases, sand or screened earth maybe required to be placed in trench beds to provide conduits with stable bases. In other cases, concrete may be required to be placed in trench beds to provide conduits with stable bases. The types of bases to be placed in trench beds to provide adequate conduit support shall be based on the plans and specifications. No abrupt vertical or horizontal changes in plane of the trench bed shall be allowed as required to assure a conduit installation that is as straight as possible to help facilitate long-distance cable jetting operations.

Contractor shall be aware of all identified and potential environmental concerns as identified in the Environmental Assessment Report during trenching and construction operations and contact CVIN LLC 48 hours prior to entering environmentally concerned areas. Contractor shall endeavor to fulfill requirements of Environmental Protection Measures (EPM's) and Best Management Practices (BMP's) at all times.

When trenches containing large volumes of water will not permit installation or jointing of conduits, water in those trenches shall be disposed of by placing layers of crushed stone in trench beds to allow the water to drain to sumps while conduits are being installed. Layers of earth or sand over stone shall be applied prior to installation of conduits. Where conditions exist that water in trenches cannot be adequately removed, systems of well-points



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paralleling trenches to lower levels of ground water to levels below bottoms of excavations may have to be employed.

Conduit entrances at opposite ends of UCVs shall be at the same levels and in the same positions with respect to side walls to facilitate conduit rodding, cable placing, and splicing. Conduit trenches shall be graded to conduit entrances of UCVs. Locations at which trench grades to UCV entrances shall begin to change will depend on the following:

- Types of conduit configurations;
- Usage of mitered conduits; or
- Employment of splayed conduits.

Installation of conduits; spacer supports; jointing of conduits with associated fittings for bends, sweeps, bell ends, adapters for jointing different types of conduits; and terminations shall be performed in accordance with conduit manufacturers' installation practices.

### ***10.4 Backfilling of Conduit Trenches***

Backfilling material installed next to conduits shall be free of stones and other materials, which could damage either conduits or conduit joints. Backfilling material shall not contain large boulders. Tamping of backfill at sides of conduits shall be performed with extreme care to avoid either damage to joints or shifting of conduit configurations. Compaction of trenches shall be as required by the permit. In cases where sand slurry is utilized, compaction is not a factor due to the sand and cement mixture. If allowed by permitting authority, Contractor may use sand slurry to backfill trenches, instead of compacted soil (at no additional cost to Owner). Before any trench is completely backfilled a warning tape (supplied by contractor) will be placed at a minimum of 12" above the conduit. The use of spacer supports (supplied by contractor) placed at distances recommended by the conduit manufacturer in conduit configurations shall aid in the prevention of shifting conduit configurations during tamping operations. Backfilling and tamping alongside conduits shall be performed in 2 in. (51 mm) thick layers until level with top of conduit configurations. Conduit trenches with concrete top protection or encasement shall be backfilled as soon as possible.

Backfill above conduits shall be thoroughly tamped in 6 in. (152 mm) layers. In most cases mechanically tamped backfill will provide better compaction than hand-tamped backfill. Where large amounts of backfilling and tamping are to be performed, backfilling and tamping machines shall be used. To avoid damage to conduits, mechanical tampers shall not be used until conduit configurations have been covered with at least 12 in. (305 mm) of hand-tamped backfill. In sandy soils, water may be used to provide satisfactory compaction when backfill is installed in 6 in. (152 mm) layers and flooded. Where cinders form part of the soil, clean earth shall be used as backfill adjacent to conduits and soils containing the cinders shall not be replaced until conduits have been covered with at least 6 in. (152 mm) of cinder-free soil. In cases where soils are composed of mainly cinders, sand slurry encasement of conduits shall be considered.

Test mandrels which are 0.25 in (6 mm) smaller in diameters than the inside diameters of conduits shall be pulled through all single conduits (not through FuturePath) to ensure proper alignments. FuturePath will be tested by jetting an 8mm hard mandrel ball (Nylon or Delrin® acetate precision BB) as specified in Section 19.3 requirements for High Air Speed Blown (jetted) Cable Installations. All conduits shall be pressure tested to 100psi for 5 minutes. The pulling or jetting of the test mandrels through the conduits and pressure testing shall be performed after backfilling (except at mid-span conduit splice locations, which shall be left accessible), but prior

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to the replacement of any grass, sod, repaving, etc. In addition, all conduits shall be cleaned of loose materials such as concrete, mud, dirt, stones, etc.

Paving or temporary repaving over conduit trenches shall be performed in accordance with local, county and/or state regulations.

All surplus matter excavated in conjunction with backfilling operations shall be removed so as not to obstruct traffic. Where space is restricted, surplus matter shall be removed at the time of excavating. If possible, small quantities of excavated materials shall remain at construction sites to be used later for filling in temporarily repaved trenches where settlement occurs.

On public rights-of-way (R/W) or lands where construction of conduit trenches require removal of sod or top soil, trench surfaces shall be restored to their original appearances by resurfacing trenches with the original sod or top soil removed during construction operations.

When the construction projects have been completed, all surplus materials and debris shall be removed from construction sites.

Conduit ends shall be sealed to prevent the entrance of foreign matter and to prevent the entrance of water or gas into UCVs or buildings. Conduits shall be sealed in accordance with conduit manufacturer's recommendations. All conduits entering central offices or other buildings shall be sealed at all times except when placing cables. If construction work extends over several days, conduits shall be temporarily sealed at night, but permanently sealed upon completion of construction.

## **11. Horizontal Directional Drilling**

### ***11.1 Work Included***

The work specified in these drawings consists of installing telecommunications using horizontal directional drilling (Bore) method of installation. This work shall include all services, equipment, materials and labor for the complete and proper installation, testing, restoration of underground utilities and environmental protection and restoration. The Bore Units (BM60D & BM61D) indicated on the Staking Sheets are the Engineer's best estimate of location and length as required to meet jurisdictional or environmental requirements and/or to avoid surface or other damage that may be associated with traditional trenching or plowing methods. Inspector & Contractor shall review all field conditions prior to construction and verify that the indicated Bore Units are accurately identified, appropriately located and actually required (notify Engineer and /or Owner of any discrepancies). If a Bore Unit can be eliminated, with the approval of the Permitting Authority and with an associated net cost savings, then the Bore Unit shall be eliminated. Also, notify Engineer and /or Owner of additional bores that are required, but are not indicated on the Staking Sheets.

### ***11.2 Quality Assurance***

The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very basic essential aspects of a proper horizontal directional drill installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the engineers approval of any aspect of any horizontal directional drill operation covered by this specification, shall no way relieve the contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the contract.

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### ***11.3 Equipment Requirements***

The horizontal directional drill equipment shall consist of a directional drill rig of sufficient capacity to perform the bore and pull back the pipe, a boring fluid mixing delivery and removal system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

#### ***11.3.1. Horizontal Directional Drill System***

The horizontal directional drill machine shall consist of a hydraulically powered system to rotate, push, and pull, hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power boring operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull back pressure during pull back operations.

The rig shall be electronically grounded during boring and pull back operations. Sufficient spares shall be kept on hand for any break downs which can be reasonably anticipated.

The bore head shall be steerable and shall provide the necessary cutting surfaces and boring fluid jets.

The drill pipe shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box pins. Tool joints shall be hardened to 32-36RC.

#### ***11.3.2. Guidance System***

The guidance system shall be proven type and shall be setup and operated by personnel trained and experienced with this system. The operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of guidance system if using a magnetic system.

#### ***11.3.3. Directional Drilling Fluid (Mud) System***

A self-contained, closed, boring fluid mixing system shall be sufficient size to mix and deliver boring fluid composed of bentonite clay, potable water and appropriate additive. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping to ensure thorough mixing.

Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5-10. Water of a lower pH or excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Boring fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of the bore wall.

The mud pumping system shall have filters in line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak free. Used boring fluid and boring fluid spilled during boring operations shall be contained and properly disposed of. A berm, minimum of 12" high will be maintained around bore rig and mixing system. Pumps and vacuum trucks of sufficient size shall be in place to convey excess boring fluid from containment areas, pits and to immediately vacuum up any spills and any "frac-out" locations.

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### ***11.4 Operations***

The inspector must be notified 48 hours in advance of starting work. The inspectors approval for beginning the installation shall no way relieve the contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the contract.

#### ***11.4.1. Personnel Requirements***

All personnel shall be fully trained in their respective duties as well as safety being a part of the horizontal directional drill crew. Training shall be provided specific to the project if any potential hazards may be encountered which have not already been included in personnel's training.

#### ***11.4.2. Horizontal Directional Drilling Procedure***

Prior to any alterations to work site, contractor shall photograph or video entire work area. Work site as indicated on drawings, within right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

Contractor shall place all SWPPP up to and including silt fence using BMP's between all boring operations and any drainage, wetland, waterway or any other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or boring fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Fuel and oil may not be stored in bulk containers within 200' of any water body or wet land.

Contractor shall notify all companies with underground utilities in the works area via USA (1- 800-227-2600) to obtain utility locates. Once the utilities have been located contractor shall physically identify the exact location of the utilities by vacuum or hand excavation. Contract shall not commence boring operations until the location of all underground utilities within the work area has been verified.

Contractor shall adhere to all applicable state, federal, and local safety regulations and all operations shall be conducted in a safe manner at all times. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to inspector.

Contractor shall avoid abrupt vertical or horizontal changes in the plane of the bore hole as required to assure a conduit installation that is as straight as possible to help facilitate long-distance cable jetting operations.

Upon successful completion of pilot hole contractor will ream bore hole if necessary to a minimum of 25% greater than outside diameter of pipe using the appropriate tools.

After successfully reaming bore hole to the required diameter, contractor will pull the capped pipe through the bore hole. In front of the pipe will be a swivel. Once pull back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole.

In the event the pipe becomes stuck, contractor will cease pulling operations to allow hydro lock to subside and commence pulling operations. If pipe remains stuck, contractor will notify inspector. Together inspector and contractor will discuss options and work will proceed accordingly.

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In some cases steel or HDPE plastic pipe, as specified on the plans, will be used as a casing sleeve to act as a route, to hold the (2) 1¼-inch HDPE conduits. Steel casing pipe shall meet the specifications of ASTM A252, Grade 2. Steel pipe shall be connected together in one length (if space permits) and capped prior to pull back operations. Steel pipe will be placed on pipe rollers or flat surface before pulling into bore hole with roller set up. The rollers must be spaced close enough to prevent excessive sagging of pipe.

### ***11.4.3. Site Restoration***

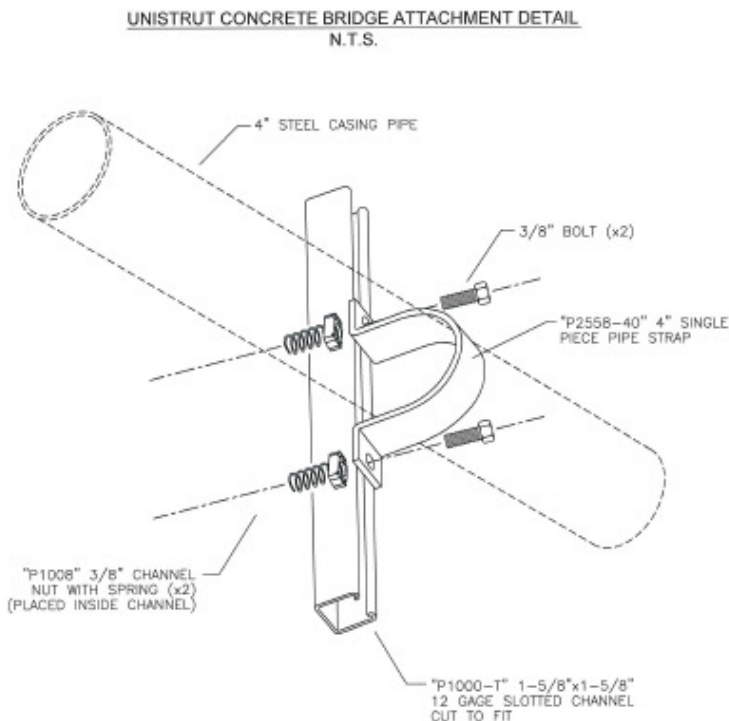
Following boring operations, contractor will de mobilize and restore the work site to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original.

### ***11.4.4. Record Keeping***

Contractor shall maintain a daily project log of boring operations and a guidance system log (bore log) with a copy given to inspector at completion of project.

## **12. Bridge Attachment Specifications**

This section provides specifications for the steel casing pipe and Unistrut bridge attachments required for this project, unless otherwise mandated by a governing permitting agency. Contractor shall be responsible for supplying all bridge attachment materials, equipment, labor, access, safety and coordination as required to meet bridge owner and permitting or governing authority requirements. All work shall be performed in such a manner as to avoid disturbing environmentally sensitive areas or dropping objects into waterways or onto roadways below bridge.

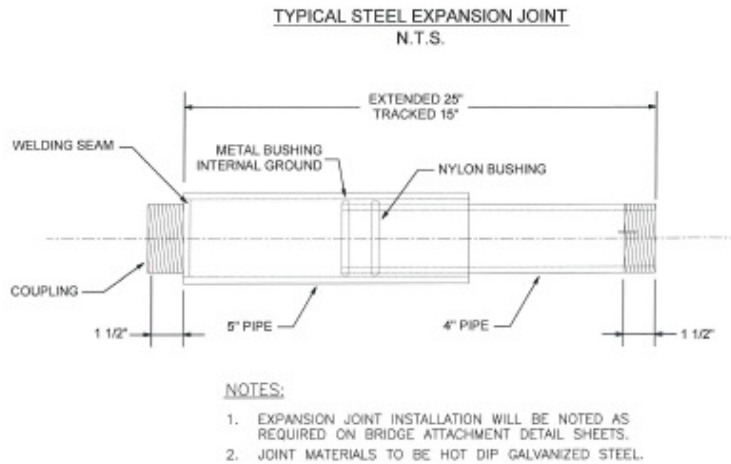


#### NOTES:

1. SLOTTED CHANNEL SHALL BE ATTACHED TO CONCRETE BRIDGE SECTION WITH (2) 3/8" STAINLESS STEEL DROP-IN ANCHORS, MINIMUM EMBED - 1-1/2".
2. PIPE SUPPORT ASSEMBLY SPACING WILL BE NOTED ON EACH BRIDGE ATTACHMENT DETAIL SHEET.

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Steel Casing Pipe shall be Electrical Rigid Metal Conduit (ERMC) meeting ANSI specification C80.1 and UL Standard 6.



### **DESIGN WEIGHT & LOAD CALCULATIONS**

MATERIAL	UNIT WEIGHT	QUANTITY	INSTALLED WEIGHT
4" (4.50" O.D.) STEEL PIPE	10.79 LBS./FT.	100'	1079.0 LBS.
UNISTRUT SUPPORT ASSEMBLY	2.76 LBS. EA.	20	55.6 LBS.
4" STEEL EXPANSION JOINT	47.0 LBS. EA.	3	141.0 LBS.
1.25" HDPE CONDUIT	0.31 LBS./FT.	100'	31.0 LBS.
1.25" HDPE 4-WAY CONDUIT WITH (4) MICRODUCTS & TRACER WIRE	0.45 LBS./FT.	100'	45.0 LBS.
72-CT. FIBER OPTIC CABLE	0.17 LBS./FT.	100'	17.0 LBS.
TOTAL INSTALLED WEIGHT:			1368.6 LBS.

(ESTIMATE)

INSTALLED WEIGHT: 1368.6 LBS.  
LOAD BEARING HANGERS: 9  
UNIT HANGER LOAD: 152.1 LBS.  
CRITICAL PART LOAD RATING: 800 LBS.  
(HANGER ASSEMBLY)  
WORKING LOAD FACTOR: 19.0%

## **13. FuturePath® and Silicore® Conduit Installation Procedures**

### **13.1 General Placement Instructions**

FuturePath® and Silicore® are proprietary names for HDPE conduit products manufactured by A-D Technologies. See Section 4 – Definitions, for more information on these products. The Owner will supply (delivered to the staging area FOB) 4-way FuturePath® and 1.25" and 1" Silicore®, for installation by the contractor on the CVNGBIP. FuturePath® will be supplied in continuous lengths of up to 8,000' per 102" reel and Silicore® will be supplied in continuous lengths of up to 9,000' per 102" reel. Contractor shall be responsible for dismantling and safely storing empty reels until picked up by manufacturer.

FuturePath® and Silicore® installations are most favorable when the reel is placed as a continuous section. Due to variables in outside plant conditions, this may not always be possible. When 12.7mm X 10mm 4-Way FuturePath® or Silicore® is installed and a joining point or splice is required, the ends must overlap by a minimum of 16 inches so as to provide sufficient material to build the splice.

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When placing FuturePath®, always keep the color patterns of both ends facing the same direction. This will make splicing easier and there will not be any braiding or weaving involved. This will also create a smaller splice bundle. If it is not possible to keep the ends facing the same direction due to outside plant conditions that is acceptable and will not affect the performance of the FuturePath®.

Continue following the FuturePath® joining instructions by neatly braiding and matching the MicroDuct color pattern. Always splice by matching up the colors. Splicing like colors to each other will help identify the MicroDucts on either end.

### ***13.2 Plowed Installation***

The purpose of this section is not to offer instruction on plowing but rather to cover specific details of using FuturePath® and Silicore® in plowing operations. Plowing is the preferred installation method for long continuous runs, primarily in rural areas. The major distinction between plowing and trenching is that trenching removes the soil from the trench, whereas plowing only displaces soil while laying in the FuturePath® and Silicore®.

#### ***13.2.1. Safety Precautions***

Before starting any underground placement operation, all personnel shall be thoroughly familiar with operating system safety practices governing but not limited to the following:

- Wear appropriate safety equipment. Guard and protect work areas.
- Locate and resolve route conflicts in easements with other utilities or buried locator services prior to plowing.
- Perform all work in accordance with applicable National, State or Local Codes and Standards.

#### ***13.2.2. Plowing Procedures***

Chute Plowing can offer significantly lower construction costs. FuturePath® and Silicore® provide the mechanical protection and strength necessary to make this method of construction practical. Plowing provides efficient duct placement without costly ground restoration. Preliminary plowing steps include:

- The inside of the chute plow must be at least ½ inch wider than the diameter of the FuturePath® and Silicore® being plowed. The radius of the bend at the bottom of the chute must be at least twelve times the outside diameter of the FuturePath®.
- Build a starter pit for the plow blade at the beginning of the route. Construct a second pit at the end of the route. The pits shall be twice the length of the blade and chute to avoid exceeding the minimum bend radius of the FuturePath® and Silicore®.
- Locate potential problem areas along the route. Excavate pits at existing service areas and around immovable objects.
- Complete the bores in the route before starting the plowing. Place sleeves in the bores where soil conditions or construction specifications require. Leave a rope in the completed bore to facilitate placing the FuturePath® and Silicore®.
- Pre-rip to the buried depth in adverse soil conditions. If the soil is rocky or tree roots are present, pre-rip the route more than once.
- When placing FuturePath® and Silicore® remember to plow in the same direction that the route was pre-ripped.
- Reduce the severity of a bend whenever a change in depth or direction is necessary.

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These installation procedures could be altered or combined throughout a given installation route to achieve the best results in a particular route. FuturePath® and Silicore® may be cut and spliced when obstructions arise that cannot be avoided. Technical Bulletins as well as MicroDuct couplers and protection sleeves kits are available from A-D Technologies.

### ***13.3 Pulling Grip Installation***

This procedure can be utilized for all versions of our FuturePath® product and Silicore®.

When placing FuturePath® and Silicore® in conduit a pulling grip is required to attach the pulling line to the FuturePath® and Silicore®. Using a ball bearing type swivel between the grip and the pulling line is also recommended. Pulling swivels relieve twisting (or radial) forces on the FuturePath® and Silicore®. The size of the grip is determined by the outside diameter of the FuturePath® and Silicore® being placed. Select a grip that will withstand a maximum load applied during a pull and is a minimum of 32 inches long. The swivel shall be sized according to the working strength of the size of the FuturePath® and Silicore® being placed.

#### ***13.3.1. Preparing for Pulling Grip Installation***

Do not remove FuturePath® and Silicore® over-sheath from the MicroDucts. Apply two layers of tape over the end of the FuturePath® and Silicore®. This will prevent debris and water from entering the MicroDucts during the placing operation.

Apply compressible bands of tape to the FuturePath® and Silicore® over-sheath before installing the grip. Make the bands more than 1/16 inch thick using either friction or duct tape. Make these bands one tape width wide. Start the first band of tape six (6) inches from the end. Place the second band of tape six (6) to eight (8) inches below the first band. Add additional bands six (6) to eight (8) apart until you have covered the length of FuturePath® the grip will cover

#### ***13.3.2. Installing the Grip***

Slip the grip over the sealed end and bands of tape. Apply tape from the surface of the FuturePath® and Silicore® over-sheath to the end of the grip.

CAUTION: The tape shall only cover one (1) or two (2) inches of the grip end. If you cover the entire grip; you will restrict its compressive potential.

Completed installed pulling grip (Silicore® not shown)





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### ***13.4 Horizontal Directional Drilling/Boring Installation***

This section describes the placing of FuturePath® and Silicore® using the horizontal directional drilling (boring) method. The intent of this section is not to offer instruction on horizontal directional drilling (boring) but rather to cover specific details of using FuturePath® in this application. The installation shall be performed in accordance with the drilling equipment manufacturer's recommendations.

When horizontal directional drilling (boring) is used, the operator shall control the horizontal and vertical movement of the bore to a specified route and depth.

#### ***13.4.1. Safety Precautions***

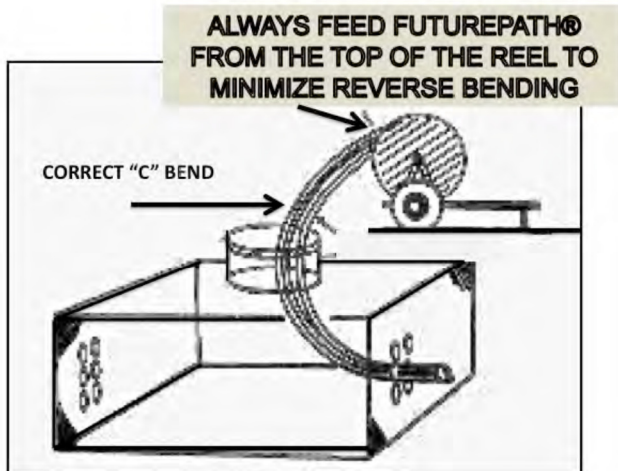
Before starting any placement of FuturePath® and Silicore®, all personnel shall be thoroughly familiar with operating system safety practices governing, but not limited to the following:

- Wear appropriate safety equipment. Guard and protect work areas.
- Locate and resolve route conflicts in easements with other utilities or buried services prior to horizontal directional drilling.
- When working with horizontal directional drilling (boring) equipment, set up and ensure adequate two-way communication exists before starting any boring operation.
- Maintain two-way communications when you cannot maintain visual contact.
- Confirm that all personnel are aware of the danger of working around horizontal directional drilling (boring) equipment and hazards while in proximity of a turning reel during pull back operations.
- Perform work in accordance with applicable National, State or Local Codes and Standards.

#### ***13.4.2. Reel Setup***

Load the reel to payout the FuturePath® and Silicore® from the bottom of the reel. Position the reel carrier so the FuturePath® and Silicore® can be fed straight from the reel into the bore. Always position the reel carrier to reduce bending.

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### ***13.4.3. Guidelines for Placing FuturePath®***

FuturePath® and Silicore® are ideal for horizontal directional drilling (boring) applications. Consideration shall be given to planning routes that are as straight as possible. Check all equipment to see that it is operating properly before starting a pull. It is important to complete the pull once a pullback operation has begun. This is important as the static coefficient of friction around the FuturePath® and Silicore® from the soil can increase if pullback is halted. If the soil has time to compress around the FuturePath® and Silicore®, the pulling strength of the FuturePath® and Silicore® can be exceeded. Should this occur the FuturePath® and Silicore® can be damaged or rendered unusable.

Always use a back reamer that is larger than the bore diameter required. The back reamer shall be at least two inches larger than the product being placed. Example: Use a four to six inch reamer for one 7 Way-16/13mm FuturePath® and an eight to ten inch back reamer for two. Utilize swivels to attach the individual FuturePath® and Silicore® conduits to pulling equipment which will minimize twisting or spiraling during placement. The use of sufficient drilling fluids will facilitate longer bores. Never exceed the safe working pull strength of the FuturePath® and Silicore® being placed.

Monitor the tension throughout the duration of the pull to prevent damage to the FuturePath® and Silicore®, equipment or personnel. Limit the first pullbacks to around three to five hundred feet. This will allow the operator time to determine if the machine, drilling head, back reamer and drilling fluids are correctly chosen for this product and the soil conditions. The length can then be adjusted accordingly. Do not exceed the angle of approach and departure during pull back.

Too sharp an entrance or exit will place an excessive amount of backpressure on the product and could cause it to stretch at these points. This may result in an installation failure. Do not use excessive speed during pull back.

Always follow the machine manufacturer's recommendations or the Plastic Pipe Institute's guidelines on pull back speeds.

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It is recommended that additional slack be pulled in the FuturePath® and Silicore® to allow for any temporary stretch that may occur in the pullback process. The amount of stretch is less than 1.5% percent of the length placed. It is suggested to pull an additional 1.5 feet for every 100 feet placed.

Do not cut the FuturePath® and Silicore® from the reel without leaving sufficient slack for it to recover from any stretching that may have occurred during placement. The FuturePath® and Silicore® will recover to its original length in about one to two hours.

### ***13.4.4. Splicing FuturePath® and Silicore® Conduits***

FuturePath® and Silicore® can be spliced, per manufacturer's specifications, after it has recovered to its original length. Individual microducts in FuturePath® and Silicore® shall be spliced using A-D Technologies "Push-fit" couplers, or equivalent, which shall be supplied by the owner. Ends of Microduct must be cut smooth and square in order to assure proper installation of couplers. Microduct splice locations shall be staggered so that couplers do not overlap. Copper trace wire in FuturePath® shall be spliced per manufacturer's specifications using copper split-bolts. Continuity tests of trace wire shall be performed as required to assure electrical conductivity between permanently accessible UCV's. The entire FuturePath® splice section shall be covered with a 2" ID Schedule 40 PVC Straight Splice Protection Sleeve Kit, which shall be supplied by the contractor. Never pull FuturePath® or Silicore® after it has been spliced. Contractor shall provide GPS latitude and longitude coordinates of all buried conduit splice points, based on NAD-83 / State-Plane coordinates, using RTK surveying techniques, as required to assure accuracy within 1 foot and install a warning sign as specified in Section 6.3.

## **14. Subsidiary Conduit Installation**

The term "subsidiary conduits" is commonly used to define any conduits branching off from main conduit runs. Subsidiary conduits shall be installed using the same construction and installation practices as defined for main line conduits.

Subsidiary conduits entering buildings shall be placed before buildings are erected if possible. In this situation, suitable sleeves or stub outs can be inserted in building walls or floors at the time of construction. If subsidiary conduits are placed after building construction, entrances shall be installed through building walls or floors at points not vital to support the buildings.

## **15. Handhole/Box (UCV) Installation Procedure**

### ***15.1 Field preparation***

Prepare the excavation approximately 6" deeper than over all height of enclosure. The length and width of the excavation shall be determined by adding 4-6" to overall length and width of UCV. Warning signs, ("Rhino Fiber 3-Rail, 78" fiber optic markers) will be placed at every UCV (except in sidewalks or other impractical urban areas), to identify the UCV location and ensure that the fiber and structures are not damaged in the future.

### ***15.2 Installation***

Placement of approximately 6" of compacted gravel base material in the excavation is the required material because of its drainage characteristics. Place a layer of ½" x ½" x 18ga. WWM galvanized hardware cloth, 6" larger than outside plan dimensions of the UCV, on top of the gravel as a rodent barrier prior to placing the UCV. Carefully trim around conduit penetrations to assure integrity of rodent barrier. At permanently accessible UCV's, all conduit ends shall be capped. At permanently buried UCV's, the 1.25" Silicore® and all four FuturePath® microducts shall be spliced together to assure a smooth continuous path through the UCV, until such time as a

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coupler is removed for installation of the fiber optic cable. FuturePath® trace wires shall be spliced together with split-bolt connectors to assure continuity of trace wire through buried UCV's. Boxes being placed below grade shall be covered with a layer of 10-mil poly sheeting and will have approximately 18" of cover over lid. Contractor shall provide GPS latitude and longitude coordinates of all UCV structures, based on NAD-83 / State-Plane coordinates, using RTK surveying techniques as required to assure accuracy within 1 foot.

### ***15.3 Backfilling***

Place selected backfill into excavation at 12" lifts and compact. Backfill around the UCV shall be compacted to 95%. The compacted material shall be leveled so the top of the box is 1"-2" above the surrounding grade, with positive drainage away from the UCV. In concrete or street applications the final 8" of the excavation shall be finished with concrete, asphalt applications will installed to the specific city/county specifications provided on the permit.

## **16. Handhold/Box (UCV) Specifications**

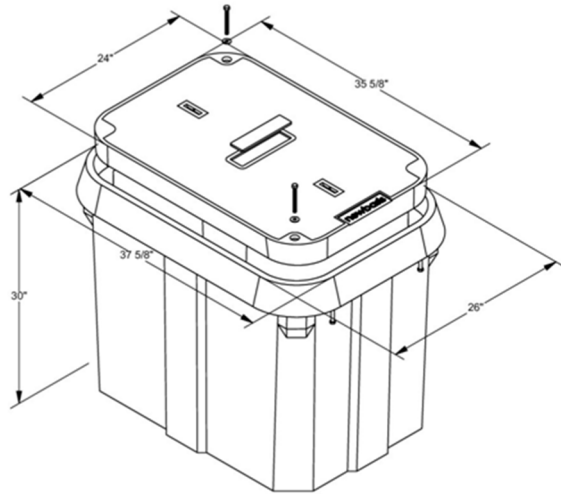
### ***16.1 Polymer Concrete Box (UCV) and Cover (24x36x30)(T)***

This UCV shall be made of polymer concrete and constructed for an intermittent traffic load rating (20k) or full traffic load rating (H20) and shall meet the requirements of ASTM Designation C857-11. The product shall have straight sides with no floor. Additional requirements include a skid resistant cover, drop in name plate ("CVIN LLC"), rodent barrier, and it shall be shipped assembled.

The UCV applications vary depending on the location of installation. The 24x36x30 UCV is available with two different load ratings that will be applicable. The H20 or "T" as it will be shown on the plans is a full traffic rated galvanized steel lid that has a 20 thousand pound wheel rating. This rating, as determined by the American Society for Material Testing (ASTM) has determined these UCV's are able to withstand traffic continually driving on the lid and top section of the UCV safely with minimal damage to the box or structure. The other load rating is a 20k rated box similar in the physical structure but does have one difference. The 20k rating is an intermittent traffic rating that specifies that the top section and lid can withstand up to 20 thousand pounds of wheel weight but only intermittently. These lids are constructed of polymer concrete and can be broken if the lid bares weight on a regular basis. These UCV's are better suited for dirt and sidewalk applications where traffic is kept to a minimum.

**Alternate:** An acceptable alternate UCV box may be fabricated from HDPE thermoplastic if it meets the load rating requirements of 20K or H20 and meets the requirements of ASTM Designation C857-11 as specified above. Covers shall still be fabricated of polymer concrete or galvanized steel as required.

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Example Product (NewBasis product shown below, equivalent product is acceptable):

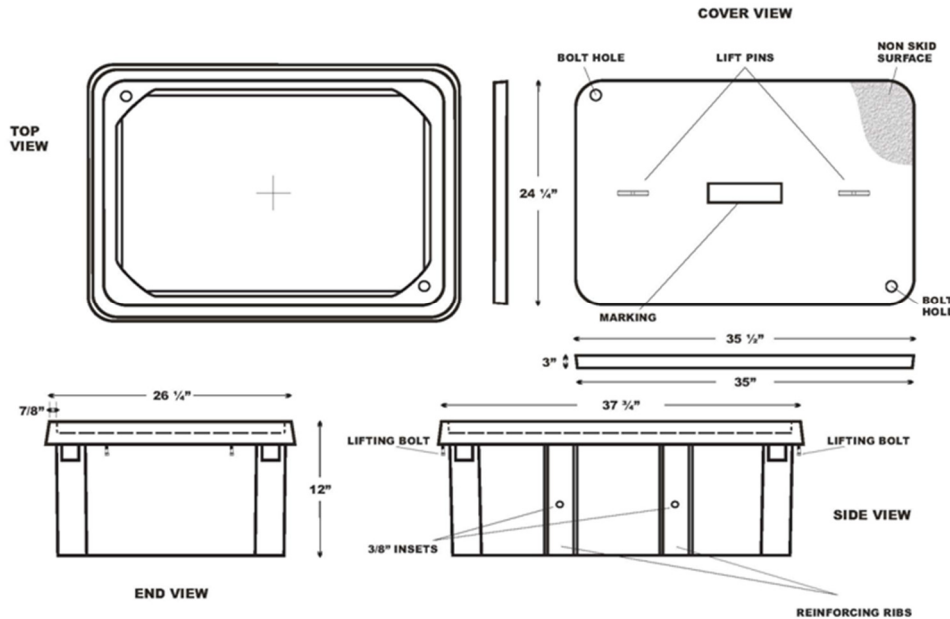
### ***16.2 Polymer Concrete Box (UCV) and Cover (24x36x12)***

This UCV shall be made of polymer concrete and constructed for intermittent traffic load rating. The product shall have straight sides with no floor. Additional requirements include a skid resistant polymer concrete cover, drop in name plate ("CVIN LLC"), rodent barrier, and it shall be shipped assembled. These boxes shall have a 20k wheel load rating and shall be designed to withstand intermittent traffic on the top section and lid.

The 24x36x12 inch UCV will be used in a rural location as assist points and as a storage location for fiber and will be buried 18" below grade after the fiber has been installed. The 1.25" Silicore® and all four FuturePath® microducts shall be spliced together through all buried UCV's to assure a smooth continuous path through the UCV, until such time as a coupler is removed for installation of the fiber optic cable. FuturePath® trace wires shall be spliced together with split-bolt connectors to assure continuity of trace wire through buried UCV's. Contractor shall cover handhole with a layer of 10mil polyethylene before burying.

**Alternate:** An acceptable alternate UCV box may be fabricated from HDPE thermoplastic if it meets the load rating requirements of 20K and meets the requirements of ASTM Designation C857-11 as specified above. Covers shall still be fabricated of polymer concrete.

## CVIN LLC - CVNGBIP Underground Plant Construction Specifications



Example Product (Martin Enterprises product shown below, equivalent product is acceptable):

### ***16.3 Concrete Vault (UCV) & Cover (36"x60"x36")(T)***

The product shall be precast reinforced concrete and will contain a bottom with appropriately sized sump to allow for extracting water.

The 36"x60"x36" UCV is a H20 full traffic rated vault with double galvanized steel lids that is constructed of concrete. This UCV has spring loaded lids due to the weight of the steel the spring is in place to assist in opening. Identification plate shall indicate "CVIN LLC". This vault will only be used in specific applications that will be designated on plans where applicable.

Example Product (Jensen product shown below, equivalent product is acceptable):

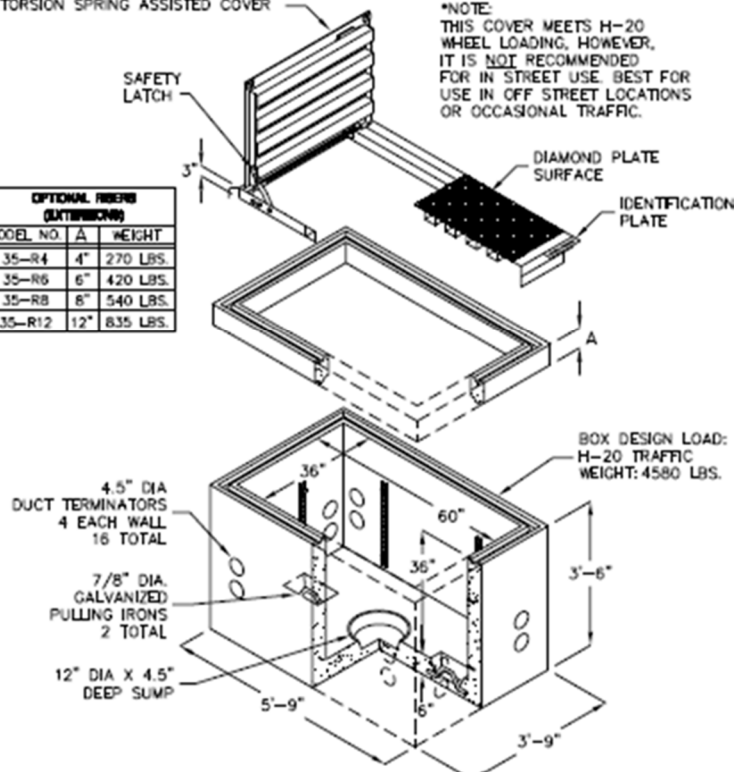
# CVIN LLC - CVNGBIP Underground Plant Construction Specifications

3'-0" x 5'-0" x 3'-0"

\*3660AT-TRF, 505 LBS. (H-20 TRAFFIC) OR  
3660AT-PKY, 403 LBS. (NON TRAFFIC)  
TORSION SPRING ASSISTED COVER

\*NOTE:  
THIS COVER MEETS H-20  
WHEEL LOADING, HOWEVER,  
IT IS NOT RECOMMENDED  
FOR IN STREET USE. BEST FOR  
USE IN OFF STREET LOCATIONS  
OR OCCASIONAL TRAFFIC.

OPTIONAL RISERS (OUTSIDE ONLY)		
MODEL NO.	A	WEIGHT
35-R4	4"	270 LBS.
35-R6	6"	420 LBS.
35-R8	8"	540 LBS.
35-R12	12"	835 LBS.



KNOCKOUTS, DUCT TERMINATORS, RACKING, PULLING IRONS,  
INSERTS, ETC. PER CURRENT FRONTIER COMMUNICATIONS SPECIFICATIONS.

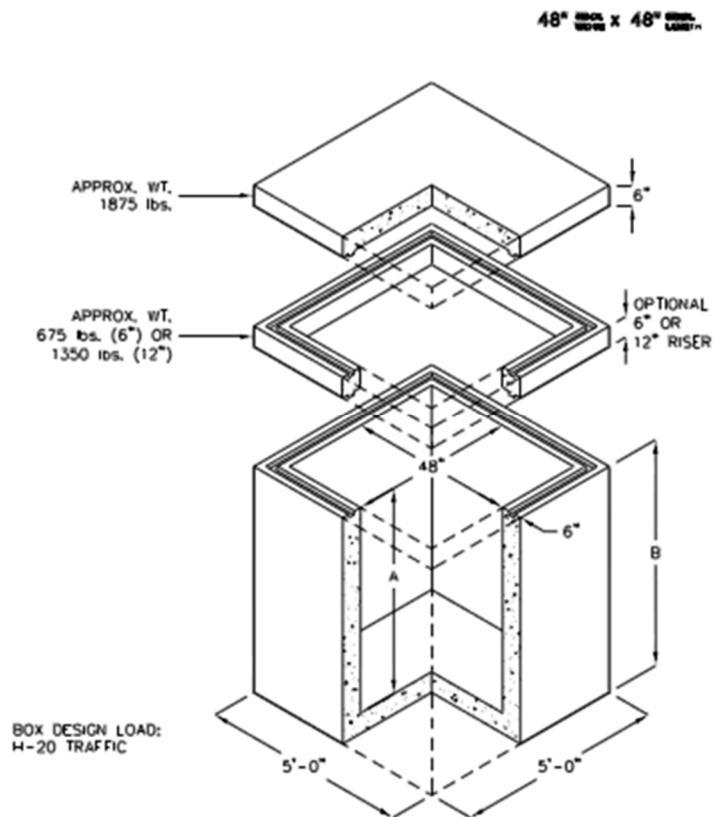
## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

### ***16.4 Universal Box (UCV) & MH Cover (48"x48"x36")(T)***

The product shall be precast reinforced concrete and designed to allow for the mounting of a circular frame and cover.

The 48"x48"x36" with 30" manhole cover is a H20 full traffic rated box with manhole cover. The box is constructed of concrete and the manhole frame and cover are cast iron. The name on the cover shall indicate "CVIN LLC". This vault and manhole frame and cover will only be used in specific applications that are in the driven roadway and will be designated on plans where applicable.

Example Product (Jensen product shown below, equivalent product is acceptable):





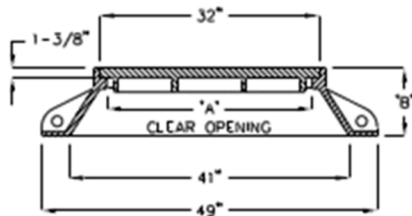
## CVIN LLC - CVNGBIP Underground Plant Construction Specifications

### **16.5 Manhole Frame and Cover Specification**

These products shall be mountable on a concrete box. The products shall be rated for full vehicular traffic. The lid must have option of engraving customer name ("CVIN LLC").

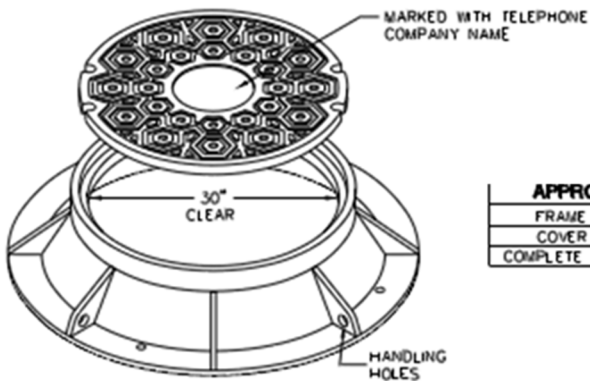
Example Product (Jensen product shown below, equivalent product is acceptable):

#### **MANHOLE FRAMES AND COVERS**



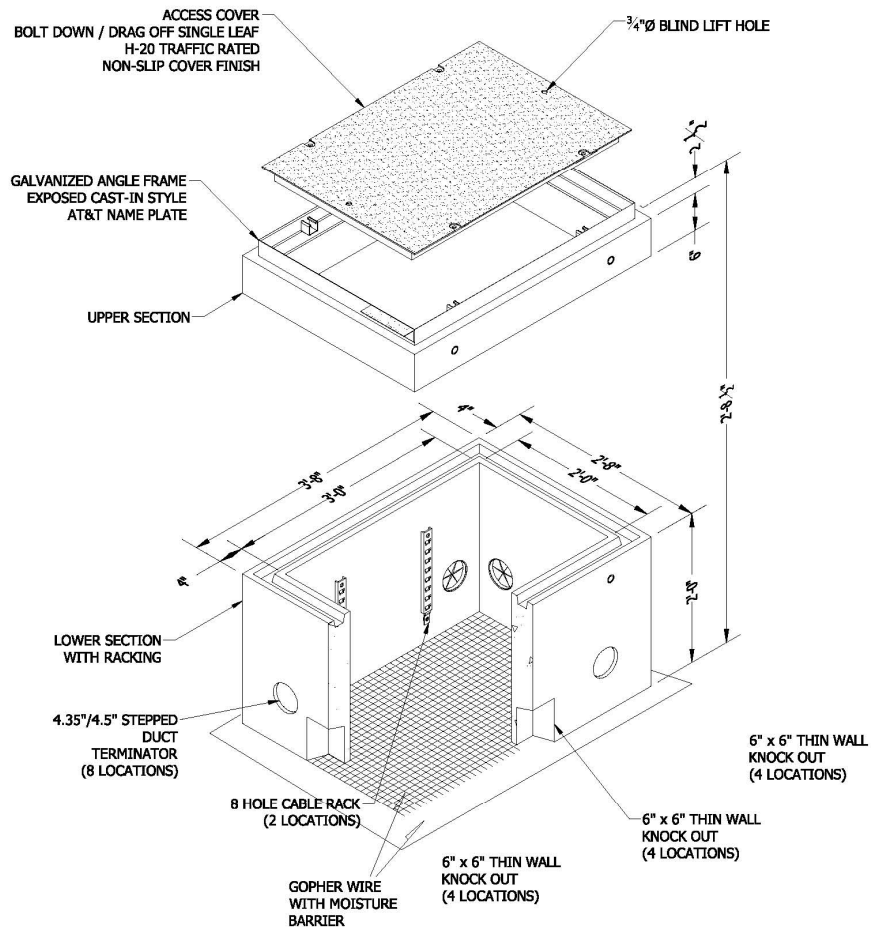
OPTIONAL FRAME & COVER TYPES			
FRAME TYPE	"A"	"B"	MODEL NO.
† B	30"	10"	B-30
*SB	30"	6"	SB-30
**R	30"	1-1/2"	R-30

† FULL TRAFFIC  
\* NON TRAFFIC (SIDEWALK ONLY)  
‡ STANDARD STOCKED FRAME AND COVER



APPROX. WEIGHT	
FRAME	465 LBS.
COVER	315 LBS.
COMPLETE SET	780 LBS.

***16.6 Traffic Rated Box Showing Rodent Guard***



## **17. Conduit Rodding & Cleaning**

Before installation of underground cables, conduits shall be rodded to determine if conduits are free of foreign obstructions, which may prevent placement of cables in conduits. Rodding consists of pulling a test mandrel through the conduit section between UCVs to remove the obstruction. The diameter of the test mandrel shall be equal to or slightly larger than the diameter of either the cable or the pulling eye, whichever is larger. See Section 10.4 and 19 for additional direction on conduit testing.

Conduits suspected or found to contain particles of earth, sand, gravel, etc. shall be cleaned by pulling a stiff bristled wire brush through the conduits.

Conduits suspected or found to be obstructed with foreign materials which cannot be removed by rodding or cleaning shall be immediately reported to the Inspector. The Inspector shall then determine what appropriate action shall be taken to alleviate the obstructions. Reaming of conduits shall not be allowed.

## **18. Requirements for High Air Speed Blown (Jetted) Cable Installations**

### ***18.1 Duct Requirements***

Duct shall be good quality high density polyethylene (with dry pre-lubrication if possible). Smooth wall, Longitudinal Ribs, Spiral Ribs recommended. Corrugated & PVC less efficient.

Duct shall be from 10 mm to 2" inner diameter.

Duct shall be clean and free of water, mud or debris. Calibrate and prove duct if necessary. It is required to plug ducts at time of duct installation.

Duct splice points shall be coupled with an airtight coupler (such as the SHERMAN & REILLY DC-10 Split Coupler or equivalent) capable of a static air pressure test at minimum of 100psi for 5 minutes.

Duct must not be stretched or stressed during installation which can cause "neck down" and cause deformation. Care shall be taken when plowing or trenching not to over stress.

Care must be taken when directional boring for duct placing not to bend, crush, or kink the Duct at bore entrance and exit points in particular.

If the integrity of the duct is in question, a hard mandrel may be blown to prove the duct. This process will only prove that duct is not restricted or "out of round."

### ***18.2 Microduct Fiber Optic Cable Placing Requirements***

Incorporates a mechanical drive unit or pusher which feeds cable into the pressurized inner duct to provide a sufficient push force on the cable, which is coupled with the drag force created by the high-speed airflow.

## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

Unit to be equipped with controls to regulate the flow rate of compressed air entering the Duct and any hydraulic or pneumatic pressure applied to the cable.

Unit must minimize or eliminate the conventional pulling lubricants and pull tapes or ropes.

Unit must accommodate smooth wall, longitudinally ribbed, spiral or waved rib ducts from nominal 10 mm to 2" inner diameters.

Must allow additional units for mid-assist or cascading to allow for greater cable lengths to be installed.

Must incorporate safety shutoff valves to disable the system in the event of sudden or drastic changes in pneumatic or hydraulic pressure.

Must not require the use of a piston or any other air-capturing device to impose a pulling force at the front end of the cable, which also significantly restricts the free flow of air through the inner duct.

Must incorporate the use of a counting device to determine the speed of the cable during Installation and the length of the cable installed.

Unit must be furnished with complete and comprehensive instructions for operation and Maintenance of each unit both in written manuals and video format and shall be operated only by equipment manufacture trained professionals.

## **19. Microduct Fiber Optic Cable Installation Procedure**

### ***19.1 Scope***

The instructions in this document give guidelines of how to install microduct Fiber optic Cable into microducts. This cable is specifically designed to be blown into microduct, thus the cable incorporates several performance differences from standard Outside Plant fiber optic cable.

Special procedures and handling instructions must be applied.

### ***19.2 Safety***

While loading or unloading cable reels, care must be taken to prevent collision with other reels, or damage to the reel itself.

The reel shall not be rolled a long distance. If it is necessary to roll the reel, it shall be rolled in the direction indicated by the arrow shown on the reel. The reel shall always be located on a flat surface and blocks placed to prevent it from rolling in either direction.

The cable on the reel shall be covered until just prior to installation to protect the jacket from exposure to the sun. Limiting exposure to the sun can also improve installation performance. The reel shall never be placed on its side.

The reel shall never be dropped (i.e. off of a flatbed truck).

### ***19.3 Microduct/Conduit Inspection***

#### **(INSPECTING THE MICRODUCT BEFORE CABLE INSTALLATION)**

Apply air pressure to microduct to test for system integrity according to the Blowing Equipment Manufacturers (BEM) recommended points within the system. Poor microduct splices or a malfunctioning air compressor may cause the air pressure to be too low. If the air pressure is too high, the duct may be kinked, clogged or restricted by some foreign matter.

It is recommended to use a foam cylinder to clean duct and remove water and debris prior to cable installation.

Blow a small hard 8mm ball through the microduct to verify that the duct is not restricted and to assure the correct color alignment of spliced FuturePath® microducts. This test shall be conducted when the conduit is installed and just prior to microduct cable installation.

### ***19.4 Cable Installation***

#### ***19.4.1. Reel Placement***

A person must assist turning the cable reel during the installation to minimize cable tension. The cable reel shall be on a reel trailer, reel jacks, or reel stands located on level ground with reel shafts mounted on ball bearings or bushings. Reels shall be center mounted with cones for easy pull off. The reel shall be positioned where the cable coming off the reel minimizes the cables' angle going. Also, this person shall be watching the cable reel to insure no wraps are overlapped and be able to stop the reel in case of emergency to avoid cable damage. The microduct Cable shall not be allowed to drag across course surfaces that might damage the outer jacket.

##### ***19.4.1.1 Cable Handling***

The specification sheet for the cable to be installed shall be read and understood In order to identify cable installation specifications such as handling limitations and installation temperature range.

##### ***19.4.1.2 Minimum Bend Radius***

The Minimum Bending Radius for all microduct Cable Designs is 15x the cable diameter for "No Load" & 20 x cable diameters for "With Load" applications; unless otherwise specified.

##### ***19.4.1.3 Kinking***

Care must be taken at all times to insure the fiber cable is never kinked. This is primarily important during installation as the cable is coming off the reel, "pushing" cable into a duct and at "figure 8" points. In the event of possible kinks the contractor will stop installing fiber and test the fiber with an OTDR. After verification that the fiber is undamaged then installation shall continue. If the fiber has been damaged CVIN LLC must be contacted immediately for instruction to fix the issue.

##### ***19.4.1.4 Crushing***

Microduct fiber cable has reduced crush resistance versus typical fiber cable. Care must be taken at all times to insure the fiber cable is never crushed. This is an issue at all times as the cable can be crushed while on the reel or on the ground. Cable on the ground in a "figure 8" must be protected from vehicular as well as pedestrian traffic

## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

at all times. Crew personnel shall not be in the habit of walking over, or carrying tools, materials, or equipment over cable lying on the ground. In the event of possible crushing the contractor will stop installing fiber and test the fiber with an OTDR. After verification that the fiber is undamaged then installation shall continue. If the fiber has been damaged CVIN LLC must be contacted immediately for instruction to fix the issue.

### ***19.4.1.5 Tension***

The microduct Cable is to be installed by microduct cable blowing technology for all distances which cannot be pushed by hand. Installation crews must use blowing equipment specifically designed and tested for microduct fiber cable to avoid damage to the cable. Most microduct fiber cable products have a tension limit of 300 lbs of pull strength, versus 600 lbs for typical outside plant fiber cable. Refer to the specification sheet for the cable in use.

### ***19.4.1.6 Installation Distances & Speed***

Sections of microduct can be linked together with couplers in order to achieve continuous duct lengths exceeding 1 mile. Microduct cables have been successfully blown distances in excess of 7000 feet. However, due to variability in duct routes and terrain, we specify a maximum of 5,000 ft in a single run for optimal cable installation performance. Lengths greater than 5000ft shall have mid-assists (per the Blowing Equipment Manufacturers procedures) or "figure 8" procedures every 5000 ft or less. Installation speeds for microduct Cable can range between 100 and 300 feet / minute, depending on blowing equipment and duct run.

## ***19.4.2. FIGURE 8 Process***

### ***19.4.2.1 Management***

The Installation Plan will indicate the approximate cable length at a "figure 8" point. Based on this figure, the foreman will determine an appropriate size and location for each "figure 8".

If the cable length exceeds 1.5 km, it may be best to make two separate "figure 8"s so each will be of a manageable size.

Security will be required for each "figure 8". This will be to protect the "figure 8" from traffic, pedestrians, and cable installation equipment.

### ***19.4.2.2 Intermediate Installation***

(AKA: BI-DIRECTIONAL)

For longer length installations, place the cable reel and blowing equipment near a hand/man hole point toward the middle of the duct run.

Blow the cable in one direction to the planned splice location.

Place the remaining cable in the shape of a "figure 8" for temporary cable management.

Performing the "figure 8" in this fashion will leave the exposed cable end on top of the "figure 8" stack. Next, blow the remaining cable length toward the opposing planned cable termination point.

### ***19.4.2.3 Backfeed Installation***

(AKA: UNI-DIRECTIONAL)

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Place the cable reel and blowing equipment at the feedhole and blow toward the back-feed hole.

At the back-feed hole, blow enough cable out of the hole to ensure ample cable to reach the end of the planned run and for planned storage at each subsequent hole.

Also, at the back-feed hole, arrange the cable in the form of a "figure 8". The cable end will be on the bottom side of the cable stack. To continue installation of the cable into the next duct section, it will be necessary to "flip" the "figure 8" stack. This shall be done with sufficient personnel to allow for the cable to be carefully and easily handled.

To continue the installation, move blowing equipment to the next cable installation leg and repeat steps to end of run.

### ***19.4.3. Slack Cable***

Slack cable can remain in the UCV after installation for storage. Contractor shall provide footage readings from cable as it enters each conduit in each UCV structure as part of the "as-built" process.

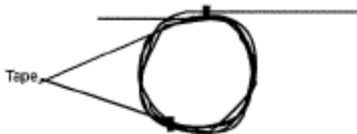
### ***19.4.4. Cable Protection in a Hand Hole***

Typically, a cable coil will be placed in a hand-hole to provide extra cable in the event of network damage or in the act of splicing fibers. In certain environments, it may be determined that cable protection is required inside a hand-hole due to the threat of rodent damage.

With a length of cable extending from the hand-hole that will be used for the coil, first determine the size of the coil that will both fit through the opening properly and also store conveniently inside.

Create cable coil to ease cable management.

Use tape or cable ties to hold the coil together.



## **20. Cable Location & Conduit Selection**

Fiber optic cables shall be placed relative to cable numbers, fiber counts, cable sizes, cutting lengths, and optical fiber types in accordance with construction drawings.

Records fiber optic cable footage installed and footage of fiber optic cables remaining on reels after cutting lengths have been removed shall be maintained for each reel of underground fiber optic cable used on the construction project.

Each fiber optic cable reel shall have a tag fixed to the outside of each flange indicating fiber optic cable footage remaining on the reel. The tag shall be updated immediately after a cut length is removed from the reel.

Conduit assignments for the fiber optic cable for all conduit sections shall typically be in the blue colored microduct inside the FuturePath®. Fiber optic cables shall be racked in UCVs or buildings in accordance with the construction drawings.

## **21. Cable Reel & Apparatus Set-Up**

Cable reels shall be inspected for flange protrusions, which could damage cable sheaths. Construction areas shall be inspected to determine if any obstructions are present that could interfere with unwinding of cables.

When cable reels are required to be moved to different locations, cable reels shall be rolled in the direction indicated by the arrows painted on the reel flanges. Cable reels shall not be permitted to tilt. Where uneven ground conditions exist that may cause reels to tilt, heavy planks or equivalent materials shall be used as runways for moving reels to avoid tilting of reels. Where it is necessary to move cable reels with construction trucks, construction truck (CT) slings or equivalents shall be used.

In conduit sections containing curves, cable reels shall be set-up at UCVs near the curves unless not permitted by traffic or other conditions.

Cable reels shall be set-up on the same opposite sides of UCVs as conduit sections in which cables are to be placed. Reels shall be leveled and aligned with conduit sections to prevent twisting of cables during installation into conduits. Cables shall be pulled into conduits from tops of reels in long smooth bends. Cables shall not be pulled into conduits from bottoms of reels.

Cables shall be removed from reels by manually rotating the reels. To eliminate cable binding during removal from reels, adjacent cable layers on reels shall not be allowed to adhere to one another.

## **22. Inspection of Construction**

The construction of underground plant facilities shall be inspected to ensure compliance with CVIN's technical, operational, environmental (including SWPPP compliance) and safety standards and specifications. This inspection shall be accomplished by having the CVIN LLC Inspector present regularly during the underground plant construction operation. The inspector shall visually check that correct conduit sizes and number of conduits; correct UCV sizes (Underground Cable Vaults, including man holes, and hand holes utilized in the CVIN LLC network design); and the fiber optic cables as indicated on sheaths/reels are installed and free of damage during the underground plant construction operations; and underground depths are in compliance with CVIN LLC and permitting specifications.

Inspector shall interface directly with local officials and inspectors as needed. Inspector and Contractor shall ensure all applicable Traffic Control Plans are implemented and correct. Inspector shall investigate and communicate all accidents, incidents, and issues of non-compliance or schedule delays to Owner in a timely manner.

The Contractor shall provide a temporary office space with desk at each segment staging area for Contractor and Inspector use. The Contractor shall provide a complete set of printed construction documents, specifications, etc. as required for documentation and recording as-built information.

When more than one underground plant construction operation is being performed at the same time, each operation shall be inspected. *The number of inspectors will vary with the number of simultaneous crews performing construction at any given time and the level of direct supervision required by CVIN LLC. The inspector shall have the authority to stop work on the project in cases of major safety violations or as may be required to address environmental issues.* During the installation of the conduit and UCV system, construction may be stopped pending the inspector's decision concerning proposed changes in the construction route from that shown on the construction drawings.



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The Contractor & Inspector shall inspect all materials upon delivery and prior to installation. Based on the inspection, the Contractor & Inspector shall make a determination if the material is suitable for construction. Unsuitable Owner supplied material, which is identified as unsuitable upon delivery, shall be replaced by the Owner. Unsuitable Contractor supplied material shall be replaced by the Contractor. In the case of nonconformance of a minor nature not affecting performance of the material, the Contractor and Owner may negotiate a basis for the use of this nonconforming material. In such cases, the specific characteristic being waived shall be noted in writing. All reels of fiber optic cables; conduit sections; and UCVs shall be inspected before installation for apparent signs of damage. In addition, fiber optic cable ends shall be sealed to prevent moisture entry into the cores fiber optic cables during transportation, in storage, and during placement.

The underground plant construction route shall be inspected before beginning construction. Discrepancies between the Construction Drawings and existing field conditions shall be brought to the attention of the Inspector and/or Owner.

Cables, conduit runs, UCVs, etc., as well as, the equipment and procedures shall be regularly inspected during the installation to prevent damage to the cables, conduits, UCVs, etc., and to ensure that proper depths of conduit runs and UCVs are maintained. Conduit runs shall be checked for damage at severe changes in grade and corner angles. The inspector shall visually check that conduit runs are properly installed in open trenches, that trenches are properly backfilled, and that ground surfaces are restored to their previous conditions. The inspector shall also visually check that UCVs are properly installed in open vault pits, that vault pits are properly backfilled, and ground surfaces are restored to their previous conditions.

Sequential markings on the outer jackets of cables are provided to facilitate the inventory of cable units. The inspector and the contractor shall agree on the inventory of underground plant units as they are installed. Construction drawings shall be appropriately marked so they can be used as permanent records of all plant items. Contractor shall prepare Daily Log Reports on the Owner's EADOC online web-based project management system and the inspector shall review and approve all Daily Log Reports. Daily Log Reports shall identify all work activities for each separate construction crew and shall provide accurate reporting of all materials installed on a daily basis.

Road and ground surfaces shall be inspected to determine if the surfaces have been damaged by the trenching and cable placement equipment. If surfaces have been damaged, surfaces shall be repaired and restored. If repairs are necessary, repairs shall be performed in accordance with Federal, State, or local codes.

### **Conduit runs shall be inspected during construction to determine that:**

- Conduits have been properly installed in trenches;
- Bore locations indicated on the Staking Sheets are accurately identified, appropriate, and actually required (notify Owner of any discrepancies). Also, notify Owner of additional bores that are required but are not indicated on the Staking Sheets.
- Conduit sections have been properly jointed;
- FuturePath duct and trace wire splices are properly assembled and protected;
- Conduits & trace wire are properly coupled at permanently buried UCV's;
- Conduits are capped at permanently accessible UCV's;
- Proper bend radius of curved conduit sections have been maintained;
- Required slope and depth of conduits have been maintained;
- Warning tape and marker posts are placed in accordance with CVIN specifications;

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- Concrete or slurry encasements have been properly installed, when required;
- Conduit mandrel and pressure tests are conducted and approved;
- Concrete bases have been properly installed, when required; and
- Top protection has been properly installed, when required.

### **Construction As-Built Record Drawings shall be accurately marked to indicate the following:**

- Routing of conduit and UCV system;
- Locations and lengths of all boring operations (collect and file all bore logs);
- Locations of UCVs, buildings, and/or pole risers in relation to streets, roads, buildings, poles, or other obstructions;
- GPS coordinates of all UCV's, and underground conduit splices;
- Distances between UCVs (wall-to-wall measurements, based upon sequential markup), and UCVs to buildings (wall-to-building measurements);
- Conduit configurations, sizes and types between UCVs, and UCVs to buildings;
- Locations of existing and proposed cables and conduits in which cables either exist or are to be installed;
- UCV, cable vault, and building cable racking diagrams indicating the positions of all existing and proposed cables and cable stubs;
- Conduit configurations indicating particular cable assignments;
- Pole and building risers indicating splice locations, supporting structures, cable attachment methods, and physical protection, when required;
- Exact footage markings on fiber optic cables at all conduit entry points in all UCV's;
- Lengths, number and types of optical fibers, and types of fiber optic cables;
- Locations of other underground utilities and obstacles.

### **22.1 *Required Tools and Equipment for Inspectors***

- "Smart" cellular telephone with voice, text, camera, and email capabilities
- Digital camera, minimum 7 megapixels, with flash, optical zoom, video, and date stamp capabilities
- GPS receiver
- Measuring wheel
- 25' tape measure
- 100' tape measure
- Personal safety equipment including hardhat, eye & ear protection, safety vest, long pants and boots
- Laptop computer with wireless internet capability
- Vehicle safety equipment including flashing amber warning lights and traffic cones

### **22.2 *Reporting and Documentation Requirements for Inspectors***

- Verify and Approve Contractor's Daily Report (in EADOC)
- Inspector's Daily Report including SWPPP verification (upload to EADOC)
- Incident and/or Accident Reports
- Change In Plan Form
- As-Built Documentation
- Digital photographs with date stamps, named correctly and descriptively with Segment # and date (Example: SEG 5, Bore @ Oak St & 5<sup>th</sup> Ave, YYYY-MM-DD)

## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

- Before/after pictures or video of roadway and ground surfaces
- All conduit splice locations
- Bore pits
- Construction details
- Locations and details of accidents, environmental incidents, spills, etc.

### **23. Splicing or Termination, Testing and Marking Fiber Optic Cables**

Underground fiber optic cables shall be spliced or terminated in accordance with the CVIN LLC Fiber Optic Cable Splicing, Testing and Acceptance Requirements (6/24/2011), and enclosed in accepted fiber optic splice cases.

After installation, fiber optic cables shall be tested in accordance with the CVIN LLC Fiber Optic Cable Splicing, Testing and Acceptance Requirements (6/24/2011), and the CVIN LLC Contract. Contractor shall install one (1) Snap-Around Cable Marker (supplied by CVIN LLC) on each end of the fiber optic cable at the point the cable exits the conduit (2 per handhole). Cable Markers shall be installed at each vault that is level with the surface.

### **24. CVIN LLC Custom Bid Units**

Detailed descriptions of all applicable underground plant assembly units are provided in the CVNGBIP Bid Unit Descriptions.

### **25. CVIN LLC Supplied Materials**

CVIN LLC shall supply the materials listed below to the contractor for use on the CVNGBIP. Contractor shall be required to obtain and maintain at least one secure staging area per segment. Staging area shall be located in a paved or graveled and previously disturbed area, well away from any environmentally sensitive areas. Provide fencing, lockable storage units, lighting, etc., as may be required to assure security of all materials. Contractor shall notify CVIN LLC at least 2 weeks prior to the desired material delivery date. Contractor and Inspector shall inspect all Owner supplied materials upon delivery, per Specification Section 22. After delivery and acceptance, Contractor shall accept full responsibility for the safety and security of the Owner supplied materials. Contractor shall scan or photograph all Owner-supplied material delivery packing slips and Bills of Lading and upload to EADOC per Section 26, and submit all original copies of packing slips and Bills of Lading to Owner along with Contractor's monthly invoice.

#### **CVIN LLC Supplied Materials:**

- Warning Signs
- 10/12mm Microducts, Caps & Couplers
- 4-Way FuturePath® HDPE Conduit, Microduct Caps & Couplers (12.7mm OD)
- 1.25" Silicore® HDPE Conduit, Caps & Couplers
- 1" Silicore® HDPE Conduit, Caps & Couplers
- UCV Handholes 24"x36"x12"
- UCV Handholes 24"x36"x30"
- UCV Handholes 36"x60"x36"
- UCV Handholes 48"x48"x36"
- Fiber Optic Micro-cable (72-count)
- Fiber Optic Micro-cable (6-count)

## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

- Fiber Optic Micro-cable Jumpers / Pigtails
- Splice Closures
- Fiber Optic Micro-cable Snap-Around Cable Markers
- BTOP Project Signage

## **26. Environmental, Cultural and Biological Resources Avoidance and Protection**

A complete environmental assessment has been prepared for the CVNGBIP by AECOM. Copies of the complete biological and cultural reports are available to the contractor on the CVIN LLC EADOC online web-based project management system. The Engineer has incorporated the Cultural and Biological Resources Avoidance and Protection Maps into the Construction Drawings (CD). The contractor shall be responsible to use Best Management Practices (BMP), as specified on the CD and in the reports, to avoid and protect said resources. Work shall be restricted to existing rights-of-way and previously disturbed areas as directed on the CD. Contractor shall participate in the Worker Environmental Awareness Program (WEAP) that has been developed and implemented for CVIN LLC and the CVNGBIP. Contractor shall cooperate with the on-site Environmental Monitors as may be required in designated areas.

Storm Water Pollution Prevention Plans (SWPPPs) have been prepared for each project segment by an AECOM Qualified SWPPP Developer (QSD) in accordance with the Construction General Permit (Order 2009-00009-DWQ, Attachments A, A.1, and A.2) and Caltrans requirements. Contractor shall be responsible for compliance and implementation of all conditions specified within Order 2009-0009-DWQ and the appropriate project segment SWPPP, which includes, but is not limited to, implementation of specified BMPs for good site management, erosion and sediment control, non-storm water management, run-on and runoff controls, inspection, maintenance and repair, reporting, and monitoring and sampling (as applicable). Contractor shall provide at their expense, a Qualified SWPPP Practitioner (QSP) to implement, oversee, update, and report SWPPP terms and conditions.

Contractor shall be responsible for providing the AECOM QSD with appropriate and accurate materials/data for amending the SWPPP as field conditions or project implementation warrants. Based on updated materials provided by AECOM, Contractor shall be responsible for physically amending the onsite SWPPP documentation.

Contractor shall be responsible for reporting to State of California's Storm Water Multi-Application Reporting and Tracking System (SMARTS) any exceedance of Numeric Action Levels (NALs) or Numeric Effluent Limitations (NELs), or any noncompliance with Order 2009-0009-DWQ. Following SMARTS uploading, Contractor shall electronically communicate such information to AECOM and CVIN LLC. Contractor shall cooperate with compliance inspectors (State representatives, AECOM, CVIN LLC, local government, and other colors of authority) and resolve any noncompliance issues within the timeline requested.

Every 90 days, Contractor shall provide AECOM with SWPPP compliance information (e.g., data, photographs, site inspection materials, and other supporting compliance assessment information required of Order 2009-0009-DWQ. AECOM will be responsible for storing, collating, and uploading segment-based SWPPP information to SMARTS as part of the Annual Report.

Contractor shall maintain a paper or electronic copy of all records required of Order 2009-0009-DWQ and make them available to AECOM upon request until the Notice of Termination has been approved by the State of California.

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Contractor shall be responsible to meet all Federal (EPA), State (CARB - California Air Resources Board), Regional And Local air pollution regulations and mandates, which may include but are not limited to the following:

- All Off-Road Construction Equipment used will be required to be registered on the CARB DOORS Program, and registration stickers visible on every piece of equipment.
- All Portable Equipment, (Air Compressors, Welders, Generators, Light Towers, Vacuums, etc.), will be required to be registered with CARB under the PERP Program and registration stickers visible on every piece of equipment.
- No equipment less than Tier II will be allowed on the project.
- Any equipment over 125 HP will be required to be Tier III.
- An Excel Spreadsheet of all equipment in use on the project will be required to be submitted, with all corresponding serial numbers and CARB registration numbers.
- The contractor will be liable for insuring all required registration and monthly reporting/recordkeeping are in place, following all California Air Resource Board requirements and any penalties or fines incurred will be the sole responsibility of the end user/contractor.

## **27. CVIN LLC EADOC Online Web-based Project Management System**

CVIN LLC has contracted with EADOC to provide online web-based project management services. EADOC's online software allows the entire construction management team of Contractors, Architects, Engineers, Consultants and the Owner to quickly exchange, manage, and maintain every part of the construction project – including documents, financial information, pay requests, change orders, RFI's, and submittals. Access to EADOC is by invitation only, from the Owner, for pre-approved companies and individuals. All CVNGBIP Contract Documents, reporting, material management, etc. will be maintained and available exclusively on EADOC. Training in the use of EADOC will be available on-line with videos, tutorials, and live "Go-To-Meeting" sessions.

During the bid phase, bidders will have limited access to EADOC for retrieving the bid documents and submitting memos and pre-bid requests for information (PBRFI) to the Owner and Engineer. Bidders who are awarded a contract for construction (Contractor) will be granted full access to EADOC.

Contractor(s) shall be responsible for at least the following activities on EADOC (although other items may be identified in the future):

- **Memos** - All non-RFI communication with Owner or Engineer
- **Daily Logs** – Shall be submitted by each Contractor crew working on the CVNGBIP to provide detailed information about daily work activities, including Bid Unit installation quantities. *It is extremely important that the Daily Logs accurately reflect the quantities installed to assure the accuracy of the Owner supplied material inventory and the Contractor's monthly pay estimates.* Daily logs shall be reviewed and approved by the Inspector.
- **Meetings** – Shall be scheduled as needed.
- **PBRFI** – Pre-bid requests for information shall be submitted to the Engineer &/or Owner by bidders during the bidding process.
- **RFI** – Requests for information shall be submitted to the Engineer &/or Owner by bidders during construction.
- **Submittals** – Contractor shall upload all materials submittal information as required for Engineer &/or Owner review and approval. Contractor shall also scan or photograph and upload all Owner-supplied materials delivery packing slips and Bills of Lading.
- **Inspections** – Request inspections as required.

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- **Documents** – Access and download all plans, drawings, and specifications, environmental and miscellaneous documents. Contractor shall print documents as needed or required.
- **Photos** – Contractor shall photograph or video record the work activities in progress as required to document the project and upload to the appropriate location in EADOC.
- **Permits** – Contractor shall scan and upload all permits obtained for the project.
- **Change Orders (CCR / CO)** – Submit and process as required.
- **SOV** – Schedule of values will be based upon the contracted amount from the Bid Proposal Form.
- **Pay Estimates** – Monthly pay estimate amounts will be prepared through EADOC reports and will be based upon the Bid Unit installation quantities that are reported by the Contractor's crew on the Daily Logs.
- **Risk** – Contractor can attach a Risk tag to a document to identify a potential extra cost item to alert the Owner and Engineer of a possible CO.
- **Miscellaneous** – Other EADOC activities as may be identified at a later date.

## **28. ARRA / BTOP Project Signage**

Owner shall purchase and supply ARRA / BTOP signage to the Contractor. Contractor shall be responsible for displaying, erecting and maintaining the signage in good condition throughout the construction of the Project. The project signage will consist of three primary components:

- **Staging Area**

Each staging area will have a large banner that will be affixed to a support structure within the secured staging area, situated to allow best viewing by the outside public and as required to safeguard against theft of graffiti on the sign. The banners will be used at the Ground-breaking Ceremony prior to being relocated to the Staging areas. The banner will include the BroadbandUSA logo, NTIA, CVIN LLC and CENIC.



## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

- **Construction Area Signs**

As a result of the rapid deployment and large geographical area that will be covered by this project, it is not feasible or cost effective to place permanent signs at any specific work location. As an alternative, CVIN LLC will provide each construction crew with two A-framed (Sandwich Signs). These signs will be deployed at the beginning and end of the expect construction for the day. The will be deployed and picked up daily by the Contractor.



- **Magnetic Signs**

Contractors will be issued magnetic signs to be placed on vehicles and equipment during the construction phase of the project.



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## **29. Close-out Documents**

At the Completion of Construction, Contractor shall submit original hard copies of the following items to the Owner (after they are scanned and uploaded to EADOC):

- All red lined as-built documentation.
- All original bore logs identifying location, length and depth of bore.
- All original Permits.
- All original testing and inspection logs and documentation.
- All original material warranties, owner's manuals, and documentation.

## **30. References**

### A-D Technologies

11400 Parkside Dr Knoxville, TN. 37934  
800-847-7661

## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

moreinfo@adtechnologies.com

### ASTE-The American Society of Test Engineers

P.O. Box 389

Nutting Lake, MA 01865-0389

aste@earthlink.net

<http://www.astetest.org>

### ASTM- American Society for Testing Materials

[www.ASTM.org](http://www.ASTM.org)

### Atkore International

16100 South Lathrop Avenue Harvey, IL 60426

800-882-5543

<http://www.unistrut.us/>

### California OSHA Regulations: programs and activities

[www.dir.ca.gov/DOSH](http://www.dir.ca.gov/DOSH)

### Directional Boring Central

[www.directionalboringcentral.com](http://www.directionalboringcentral.com) (directional bore specifications)

### Draka, Microduct Fiber Optic Cable Installation Procedure

2512 Penny Road, Claremont, North Carolina, 28610-0039

800-879-9862

[www.drakaamericas.com](http://www.drakaamericas.com)

### Duraline Future Path Technical Bulletins

DCEB-04003 January 2005

DCEB-08007 April 2009

DCEB-06002 August 2009

DCEB-08001

<http://www.arncocorp.com/>

### Federal OSHA Regulations: programs, and activities

[www.osha.gov](http://www.osha.gov)

### Jensen Precast

5400 Raley Blvd. Sacramento, CA 95838

800-843-9569

<http://www.jensenprecast.com/>

### Martin Enterprises

7231 Boulder Ave. Highland, CA 92346

951-928-8713

<http://www.martinfrp.com/>



## **CVIN LLC - CVNGBIP Underground Plant Construction Specifications**

### NewBasis

2626 Kansas Ave. Riverside, California 92507

951-787-0600

<http://www.newbasis.com/>

### Rhino Marking & Protection Systems

800-522-4343

<http://www.rhinomarkers.com/>

### Under Ground Service Alert / USA

4005 Port Chicago Hwy Suite 100, Concord, CA. 94520

800-227-2600 (811)

[www.usanorth.org](http://www.usanorth.org)

### United States Department of Agriculture, Rural Utilities Service Bulletin 1751F-644

[http://www.rurdev.usda.gov/RDU\\_Bulletins\\_Telecommunications.html](http://www.rurdev.usda.gov/RDU_Bulletins_Telecommunications.html)